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Water Chlorination
Crossroad of Uncertainties and Decisions

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WATER CHLORINATION:
CROSSROAD OF UNCERTAINTIES AND DECISIONS

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16. ABSTRACT

This overview introduces proceedings of the Fifth Water Chlorination Conference convened to review technical reports on all aspects of the use of chlorination, its by-products and environmental effects. Authors raise the following issues: (1) the need to better detect, analyze, and track carcinogenic and mutagneic by-products; (2) the need to be able to moderate if not minimize chlorination to rates that are realistic for high-use waters and to be able to calculate and analyze what realistic means; (3) the need to assess and to anticipate the potential to produce chlorine resistant pathogens; and (4) the need to examine disinfectant alternatives, especially for municipal and industrial treatment, to minimize or prevent formation of toxic by-products in the chlorination-reactors of treatment plants.

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The chlorination of water is at the crossroads of the issues of health, quality of water resources, scientific uncertainties, and decisions to regulate or revise our theories and practices of application. In our current rush to decrease regulation per se, and to increase common consensus for mutual benefit, water chlorination stands out clearly as the proverbial horns of a dilemma. It is not an issue that we seek to minimize disease; healthy societies are those where potable water sources abound. It is not an issue that efficiency of power generation is equated with minimizing interfering surface growth and deposits in heat exchangers. Few public spirited citizens argue against achieving the objective of swimmable, drinkable, or fishable water in our ponds, streams, lakes, rivers, and bays.

The objectives of water chlorination are repeated often enough to become a litany of tenets in the dogma surrounding public health and welfare and the richness of our society. Chlorination is the application of our commonest microbial pesticide to achieve those uncontested objectives. Dogmas, however, can be dangerously simplistic in the realm of reality where we are faced with expecting the unexpected. Thus, chlorination also is a source of demonstrable mutagenic and carcinogenic compounds. These compounds arise from reactions with precursors

from natural products of forests and streams as well as from our treated wastes or industrial and agricultural by-products. The water we use for cooling electric power generators totals more than all other uses (irrigation and drinking combined). Are we chlorinating all this water? Because water is man's single most important resource, our responsibliities in the use and treatment of water rank among the most strategic decisions we regularly make.

We expect, as a society, to enjoy good health and receive basically disease- and toxicant-free water and food. Public discussion of any possible loss of those "deliverables" results in panic and outrage. Uncertainity regarding risk on the part of a research scientist becomes evidence for public reprimand, if not cause for dismissal or banishment. The issue, therefore, is not chlorination, but truly the ready supply of "safe" water to every citizen. The citizen is not amused by computer games that estimate how much time has elapsed since the last use of his or her water. This citizen doesn't want to know there is risk of a toxicant in the water, nor does he or she want to catch a fish with signs of abnormalities, tumors, or disease. The citizen feels that taxes, elected officials, and public supported technocrats are part of a universal guarantee of health and clean water.

Water Chlorination: Basic Issues

It is popular to say that we excel in science, interpretation and evaluation of risk, and application of knowledge to policy decisions. When we examine the scientific knowledge relative to

chlorination, by-products, and environmental effects together with current policies, the statement of one researcher comes to mind: "It is clear that chlorination is the disinfectant of choice because man is the resistant species!"

In these proceedings of the Fifth Water Chlorination Conference, we present technical reports on all aspects of the subject, which most people would rather not know about personally. The avoidance of the subject is apparently spreading to many managers and decision makers as evidenced by their absence from the conference, which may have unpleasant portents for the future. If technical data are to be interpreted and evaluated effectively evaluated, there simply must be realistic suport for the effort from environmental managers and government agencies. Risk assessments are not reliable without well-designed research and careful challenge and interpretation. As we approach this crossroads of issues, we encounter a number of flashing yellow warning lights:

1. The need to better detect, analyze, and track carcinogenic and mutagenic by-products.

2. The need to be able to moderate if not minimize chlorination to rates that are realistic for high-use waters and to be able to calculate and analyze what realistic means.

3. The need to assess and to anticipate the potential to produce chlorine resistant pathogens.

4. The need to examine disinfectant alternatives, especially for municipal and industrial treatment, to minimize or prevent formation of toxic by-products in the chlorination-reactors of treatment plants.

Progress can be achieved through open dialogue and development of conceptual approaches and decisions. In the case of water chlorination, there is a very real dilemma. The presence of cancer-inducing compounds is established, but both chemical and biological investigations to follow up on these observations and to define critical parameters have not been adequate. The mutualism necessary to pursue aggressive approaches to problem solution is absent. Many decision makers and managers appear to "wish away" any acknowledgment that this problem exists, while researchers find and present, even on television, new evidence for concern. How long can we continue to say, "The research results are inconclusive?" This absence of dialogue may be the most crucial gap in our continued well being, much less our very survival. At the very least, it is a time bomb yet to be deactivated.